

Water Main Rehabilitation Plan and Schedule - Exhibit 9

Providence Water

The following is Providence Water's Water Main Rehabilitation Program for our 20-Year IFR plan for the period from fiscal years 2016 (beginning July 1, 2015) to fiscal year 2035 (ending June 30, 2035).

Included with this section is a more specific plan for the next 5-year period. The 5-year plan targets the highest priority areas taking into consideration such factors as road moratoriums, paving programs, and other factors described in the criteria for ranking the rehabilitation of water mains.

Our water system consists of approximately 1000 miles of transmission and distribution mains. Unlined cast iron main comprises about 550 miles of the system and was installed up until about 1950. Since we aggressively began rehabilitating water mains in 2013, we have cleaned/lined or replaced about 24.8 miles of water mains which is approximately 4.5 percent of the unlined cast iron water mains in the distribution system.

The 20-year main rehabilitation program was determined by defining an evaluation criteria and creating a ranking system for the criteria. The criteria are ranked from what we determine to be the most significant factors (5) to the least significant factors (1). The criteria and rankings were then combined with the GIS database as explained later. The criteria and rankings were created in-house by individuals with extensive experience and knowledge of the Providence Water distribution system. The criteria and rating system are listed as follows.

<u>Criteria</u>	<u>Ranking</u>	<u>Criteria</u>	<u>Ranking</u>
Water Quality	5	Special Considerations	3
Condition	5	Age	3
Flow	5	Dead End	2
Cast Iron	4	Bleeder	2
Model	4	Lead Services	1
UDF	4	Soil	1
		Leaks	1

An explanation of each of the criteria items are as follows.

Water Quality, are confirmed water quality problems mostly originating through customer complaints because of discolored water. The origin of the water quality complaints and all follow-up actions are tracked and maintained in a GIS database to include each action taken in the process to verify that the complaint is valid.

Condition, are mains where there are either, (1) known structural issues with the main caused by deterioration of the pipe's exterior or, (2) where the interior of the main is known to be encrusted with heavy tuberculation or corrosion. In March 2013, Providence Water began a program; that when every time a main is opened, for example, because of a water main break or a valve replacement, the interior and exterior of the main is photographed to document the pipe's condition. Also, if a condition assessment of the main is performed using nondestructive testing, such as, electromagnetic testing, ultrasonic testing, and/or acoustic soundings, etc., the results are thus noted in this category. The main is ranked as a high priority when it is in less than satisfactory condition and a candidate for replacement or rehabilitation.

Flow, is when a hydrant flow test is conducted on a main to determine the available flow on what a hydrant can provide. When the results do not meet acceptable industry standards as defined by the National Fire Protection Association the main is noted in the database.

Cast Iron, are distribution mains that are unlined cast iron pipe ranging in size from 6 to 12 inches in diameter installed between 1871 and 1950. Beginning around 1950, the interior of cast iron water mains began to be coated with a protective cement lining. Almost all of the water mains installed in the Providence Water System up until 1950 were of the unlined variety, and today approximately 55% or 550 miles of the water mains in the system are unlined cast iron. These mains have become problematic in terms of both water quality and delivery capacity.

Model, are mains identified by the hydraulic model, where computer model generated main pressures and flow data are compared to actual hydrant flow field test results. The mains are identified when hydraulic issues are identified.

UDE, are mains identified from the Unidirectional Flushing Program, where the main is run under stress conditions in the field and main pressures and flow data are acquired at the time. The field data is then compared against the hydraulic model simulation. Mains are identified when hydraulic issues are identified.

Special Consideration, are mains that supply special customers such as hospitals, dialysis centers, hotels, restaurants, laundry mats, etc. By definition alone, even though the main supplies these “special” customers, the main may be in very good condition and does not require replacement. However combined with other essential criteria, the main may become a candidate for replacement.

Age, is the age of the water main from when the main was first installed to the present year date (2015). Age is graduated on a linear scale from the oldest mains in the system to the most recently installed mains with the oldest mains receiving the highest ranking.

Dead Ends, are mains that are not looped that receive a supply of water from only one source. Dead end mains are not always located on dead end streets. Because these mains are not tied in, the flow velocities for these mains are sometimes low which leads to these mains having a higher degree of water quality complaints and flow issues than mains that are tied in.

Bleeders, are mains installed with a small diameter bleeder pipe at the end section of a dead end main, that continuously runs water-to-waste. A bleeder pipe can also exist on both sides of a divisional valve connecting the two segments of pipe. A divisional valve is an intentionally closed valve in the system that separates two distinct pressure zones which in effect causes two dead end mains. The general purpose of bleeders is to alleviate discolored water complaints resulting from dead-end conditions of unlined cast iron pipes.

Lead Services, are main segments containing active lead service connections.

Soil, are soil corrosivity ratings for areas in the Providence Water system. The soil ratings are based on soil corrosivity for two common structural materials, uncoated steel and concrete, as determined by the US Department of Agriculture, National Resource Conservation Service (Soil Properties and Qualities).

Leaks, are mains where a high rate of leaks have occurred in the system. Generally leaks are not currently problematic in the Providence Water system. There are no areas in the system with a high frequency of leaks.

Planned construction and planned paving projects are considered part of the criteria for main replacements and when relevant we will address these mains separately and evaluate these mains on a case by case basis taking into consideration all of the other criteria for the replacement / relining of water mains. Related to this, we also take into consideration streets

that have recently been repaved within our service area to address the respective moratoriums by the Cities and Towns on street openings.

Providence Water took the criteria from the table and created a field for each piece of criteria in the GIS database water main layer. The water main layer is one part of a dataset that contains all of the information for Providence Water's GIS water assets. The layers inside the dataset are linked together as part of a spatial mapping network. The network defines the relationship between the layers and allows Providence Water to use GIS's spatial and database tools to determine and assign values for each piece of criteria to each GIS main segment. The data is then exported from GIS to Microsoft Access where a rating for each main segment is calculated. The calculated rating is then linked back into the GIS water main layer to create a map of each main segment where a color is applied based on its calculated rating.

At some point, and addressed in our overall IFR plan, Providence Water plans on performing a condition assessment using available technologies and applications accepted by the water industry for small and large diameter pipe. This condition assessment ranking will be rated in the **"Condition"** criteria database field, as described above in the definitions. During the present time, mains are assessed during construction by direct observation of the exterior of the pipe when the main is excavated, and / or inspection of the interior of the main when the main is exposed. In addition, hydraulic modeling and the results from the unidirectional flushing program are used to assess the condition of the main, and locations where water quality complaints and flow issues are documented.

Overall, Providence Water uses this tool and utilizes engineering judgment and institutional knowledge for assessing and analyzing the mains for replacement / cleaning and lining for its infrastructure replacement program.

Two GIS maps are included in this exhibit. The first GIS map shows the overall conceptual priority of our water main rehabilitation program over the next 20-year period. It shows approximately 250 miles of 550 unlined cast iron mains. The second GIS map is our 5-year plan which shows approximately 70 miles of mains. Realistically over that period, we will rehabilitate approximately 50 to 60 miles of mains. However, the intent of the GIS map for the 5-year plan is to globally identify areas having the highest priority and probability for replacement. In all likelihood, most of these mains will be replaced, however factors and conditions routinely change, and for that reason we identify 70 miles. Included with the map is the projected list of streets targeted for rehabilitation. The GIS maps and the plan are conceptual and subject to changing criteria and conditions in the system as they occur.

The GIS color maps are not the sole tools and guidelines for determining our water main replacement schedule. For example, a cast iron main may qualify as a candidate for replacement because it may be unlined cast iron, and located within an area, or in close proximity to an area, of other water mains scheduled for replacement. Furthermore, to minimize costs, we may choose mains to take advantage of the logistics of where a contractor is mobilized. We may also choose lower priority areas to replace cast iron mains on primary and secondary roads scheduled for resurfacing, or in areas where other utility contractors are performing their rehabilitation work. The color maps are one factor in prioritizing main replacements in collaboration with human assessment, institutional knowledge, and engineering judgment.

The infrastructure replacement plan is a living document, and as specific planning, design, and implementation are in process, we intend to modify the plan to adjust to changing field conditions. Our main replacement plan is based on the best available information we have at this current time.

Water Main Rehabilitation Projected 20 Year Plan (2016 - 2035)

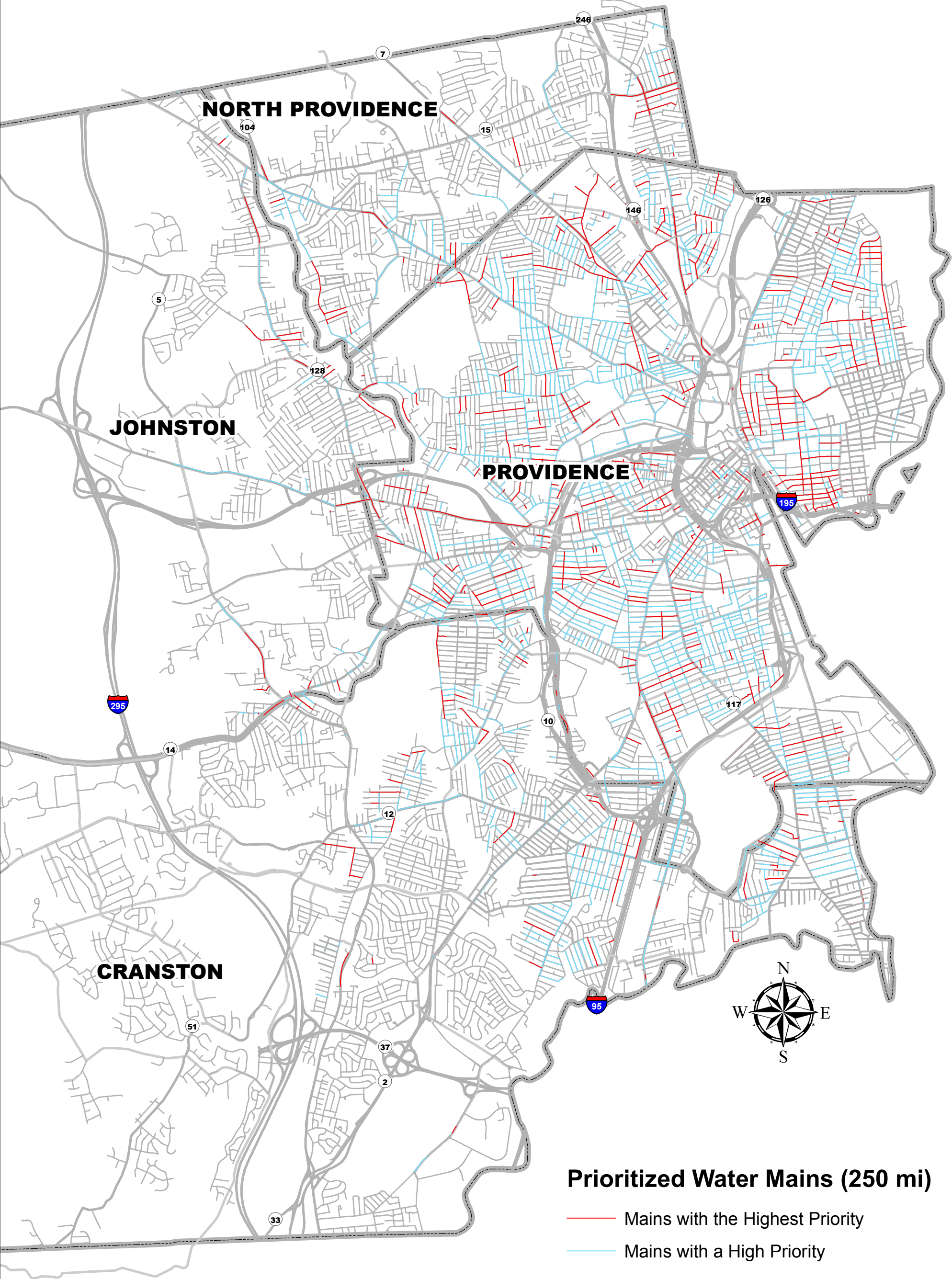
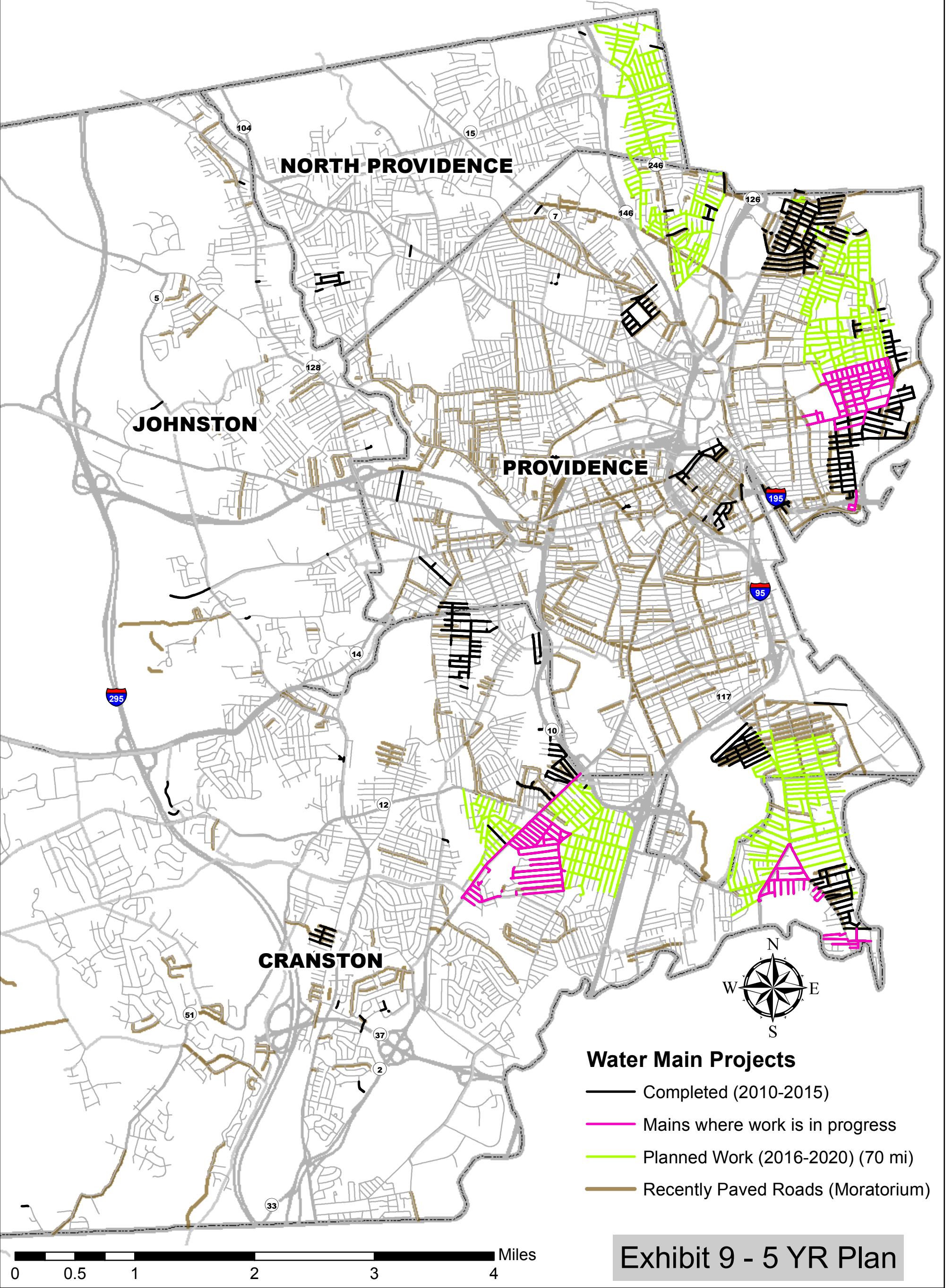


Exhibit 9 - 20 YR PLAN

Water Main Rehabilitation Projected 5 Year Plan (2016-2020)



Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
AAA WY, CR	213
ABBOTSFORD CT, PR	341
ADA ST, NP	232
ADAMS ST, NP	1,513
ALABAMA AV, PR	2,369
ALASKA ST, PR	257
ALBERT AV, CR	1,005
ALBERT AV, NP	1,002
ALDRICH TE, PR	199
ALUMNI AV, PR	366
AMBROSE ST, NP	1,152
AMORY ST, PR	619
ANDERTON AV, NP	710
ANGELO AV, NP	606
ANN ST, NP	167
ANN ST, PR	374
ARGOL ST, PR	1,152
ARLINGTON AV, PR	1,086
ARMINGTON AV, PR	1,240
ARMINGTON ST, CR	700
ARNOLD AV, CR	2,506
ASCHAM ST, PR	666
ASHTON ST, PR	988
ASTRAL AV, PR	377
ATWOOD AV, NP	703
AUBURN ST, CR	2,182
AUSDALE RD, CR	2,070
AVENTINE AV, PR	671
BAIRD AV, NP	1,573
BALTON RD, PR	594
BARBERRY HL, PR	521
BARTLETT AV, CR	1,817
BASSETT ST, NP	159
BAYARD ST, PR	349
BAYVIEW AV, CR	1,870
BEACHMONT AV, CR	386
BEACON CI, CR	1,248
BECKWITH ST, CR	3,098
BENEDICT ST, PR	675

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
BETSY WILLIAMS DR, CR	1,690
BETSY WILLIAMS DR, PR	865
BISMARCK ST, PR	627
BLACKSTONE BV, PR	7,351
BLAINE ST, PR	660
BORAH ST, NP	1,068
BRAMAN ST, PR	365
BRANCH AV, PR	302
BREWSTER ST, PR	244
BRIAR HILL RD, NP	572
BRIGHTSIDE AV, CR	198
BROAD ST, CR	3,259
BROAD ST, PR	2,566
BROOKWOOD RD, CR	1,032
BROWN AV, NP	386
BROWN ST, NP	11
BURLINGTON ST, PR	666
BURNSIDE ST, CR	1,109
CALAMAN RD, CR	2,717
CALIFORNIA AV, PR	2,665
CAMPBELL AV, NP	1,121
CAROVILLI ST, NP	1,060
CENTRAL ST, CR	459
CHACE AV, PR	591
CHARLES ST, NP	4,494
CHARLES ST, PR	214
CHARLOTTE ST, NP	1,171
CHATHAM ST, PR	1,602
CHESTNUT AV, CR	35
CLARENCE ST, CR	2,258
CLARENCE ST, NP	145
CLARENDON AV, PR	948
CLEVELAND ST, NP	1,542
CLIFDEN AV, CR	221
CLIFFDALE AV, CR	1,323
COLE AV, PR	6,968
COLUMBIA AV, CR	1,913
COLUMBUS BV, CR	1,498
COMMODORE ST, PR	1,361

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
COMO ST, PR	135
CONCA ST, NP	253
COOPER ST, NP	1,106
CROTHERS AV, CR	1,638
CYR ST, PR	227
DENISON ST, PR	346
DENNIS AV, CR	799
DENVER AV, CR	790
DEPINEDO ST, PR	1,072
DICKINSON AV, NP	1,566
DIXON ST, NP	376
DOANE AV, PR	407
DODGE ST, NP	286
DORA ST, NP	252
DORIC AV, CR	3,174
DOYLE AV, PR	1,458
DUNHAM AV, CR	209
EAMES ST, PR	594
EDDY ST, PR	1,616
EDGE ST, CR	377
EDGEWOOD AV, CR	1,657
EDGEWOOD BV, PR	2,034
EDGEWORTH AV, PR	645
EDWARDS ST, PR	312
ELDRIDGE ST, CR	2,103
ELGIN ST, PR	293
ELMGROVE AV, PR	6,341
ELMWAY ST, PR	545
ELSIE ST, CR	1,176
EMELINE ST, PR	1,858
ERNEST ST, PR	248
EVERETT AV, PR	1,380
FARRAGUT AV, PR	976
FC GREENE MEMORIAL BV, PR	930
FERNCREST AV, CR	842
FIFTH ST, PR	705
FISHER ST, PR	351
FLORA ST, PR	1,197
FLORENCE ST, PR	902

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
FOREST ST, PR	383
FOSDYKE ST, PR	1,538
FOURTH ST, PR	1,321
FRANCIS AV, NP	725
FRANKLIN ST, NP	441
FRANKLIN ST, PR	255
FRED GREEN MEMORIAL BV, CR	386
FREEMAN PW, PR	3,046
GAIL AV, CR	199
GANGWAY A ST, NP	194
GARDEN ST, CR	4,098
GARFIELD ST, NP	1,869
GARLAND AV, CR	797
GILLEN AV, NP	1,514
GOLDSMITH ST, PR	686
GORTON ST, PR	587
GRACE ST, CR	2,591
GRAFTON ST, PR	633
GRAND AV, CR	2,123
GREATON DR, PR	322
GREELEY ST, PR	1,432
GREENWOOD ST, CR	3,102
GREYLOCK AV, CR	720
GRISWOLD AV, CR	400
GROSVENOR AV, NP	908
GROTTO AV, PR	212
HADDON HILL RD, CR	446
HAGAN ST, PR	384
HALL ST, PR	1,055
HAMPTON ST, PR	579
HART ST, PR	309
HARWICH RD, PR	872
HAZARD AV, PR	1,473
HEMALIN RD, CR	430
HENRY ST, CR	428
HIGH ST, NP	106
HODSELL ST, CR	422
HOLLY ST, PR	959
HOPE ST, PR	1,875

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
HORTON ST, PR	479
HUMBERT AV, CR	872
HURDIS ST, NP	862
IANTHE ST, PR	283
INDIAN RD, CR	229
INDIANA AV, PR	2,552
INGLESIDE AV, CR	1,042
INTERVALE RD, PR	1,193
IVY AV, CR	1,277
JANE ST, NP	1,903
JILLSON ST, PR	667
JOB ST, PR	1,361
JOSEPHINE ST, NP	14
JULIA ST, CR	881
JUNE ST, NP	541
KNOLLWOOD AV, CR	3,307
LAMBERT ST, CR	576
LANGDON ST, NP	405
LANGDON ST, PR	3,271
LANGHAM RD, PR	382
LARCH ST, PR	432
LAUREL AV, PR	2,777
LAUREL CT, PR	347
LAURENS ST, CR	1,493
LAURISTON ST, PR	700
LEDGE ST, PR	1,753
LEGION WY, CR	1,649
LENA ST, NP	630
LEWIS ST, PR	351
LILLIAN ST, NP	864
LINCOLN AV, NP	566
LINCOLN AV, PR	899
LINDEN DR, PR	330
LOCKMERE RD, CR	605
LOJAI BV, NP	974
LOMBARDI ST, PR	240
LONG MEADOW DR, NP	424
LOOKOFF RD, CR	530
LORETO ST, PR	431

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
LORIMER AV, PR	1,697
LORRAINE AV, PR	678
LUNA ST, PR	780
LUZON AV, PR	490
LYNDON RD, CR	885
MAC GREGOR ST, PR	633
MACLAINE DR, NP	281
MAGNOLIA ST, CR	995
MAGNOLIA ST, PR	1,575
MALVERN ST, PR	490
MANHATTAN ST, PR	482
MARCY ST, CR	660
MARIETTA ST, PR	951
MARION AV, CR	504
MARION AV, PR	458
MARK DR, NP	451
MASSACHUSETTS AV, PR	2,538
MAURAN ST, CR	1,328
MAY ST, NP	969
MAYFLOWER ST, PR	370
MC MILLEN ST, PR	693
MEADOW AV, NP	2,091
METCALF ST, PR	1,052
MINERAL SPRING AV, NP	3,439
MONITOR ST, NP	105
MONTGOMERY AV, CR	350
MONTGOMERY AV, PR	2,193
MONTICELLO ST, PR	798
MORRIS AV, PR	3,658
MORRISON ST, PR	334
MOUNT AV, PR	731
MUTUAL ST, PR	278
NAHANT ST, PR	537
NARRAGANSETT BV, CR	6,451
NARRAGANSETT BV, PR	909
NARRAGANSETT ST, CR	2,643
NELLIE ST, PR	197
NEW YORK AV, PR	1,055
NEWBERRY ST, PR	434

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
NORMAN DR, NP	190
NORTH CLARENDON ST, CR	888
NORTHUP AV, PR	1,059
NORTHUP ST, CR	1,846
NORWOOD AV, CR	6,140
NOWELL RD, CR	88
OBED AV, NP	2,058
OCEAN AV, CR	877
OCHIL PL, CR	18
OHIO AV, PR	2,565
OLIVER ST, NP	448
OPPER ST, PR	1,251
ORCHARD DR, CR	427
ORCHARD ST, CR	1,608
ORCHARD ST, NP	534
ORLANDO AV, CR	437
ORLANDO DR, NP	1,979
PARK AV, CR	3,762
PAUL ST, PR	200
PAWTUXET AV, CR	2,258
PIAVE ST, NP	64
POND ST, CR	685
PONTIAC AV, CR	1,764
POPLAR ST, PR	406
POTTER ST, CR	2,332
PRESTON DR, CR	1,728
PROSPER ST, PR	665
RANDALL RD, NP	751
RAPHAEL AV, PR	498
RAY ST, PR	315
REMINGTON ST, NP	196
RESERVOIR AV, CR	33
RHODES AV, CR	648
RICHARD ST, CR	2,687
RICHLAND RD, CR	1,328
ROCHAMBEAU AV, PR	1,352
ROGER WILLIAMS PW, PR	183
ROLFE SQ, CR	1,647
ROOSEVELT ST, PR	421

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
ROSE CT, PR	382
ROSE ST, NP	910
ROSELAND AV, CR	320
ROSLYN AV, CR	585
ROSLYN AV, PR	689
ROYAL LITTLE DR, PR	202
RUSSO ST, PR	1,144
RUTHVEN ST, PR	248
SARAH ST, PR	293
SARGENT AV, PR	963
SAVOY ST, PR	1,335
SEFTON DR, CR	191
SESSIONS ST, PR	2,149
SHAW AV, CR	1,791
SILVER SPRING ST, PR	4,738
SIXTH ST, PR	1,340
SLATER AV, PR	3,233
SMITH ST, CR	1,853
SMITHFIELD AV, PR	95
SOCIAL ST, PR	622
SOUTH CLARENDON ST, CR	1,491
SPENSTONE RD, CR	416
SPRING ST, NP	391
STADIUM RD, PR	551
STANHOPE ST, PR	766
STEVENS RD, CR	932
STONE ST, PR	574
SULLIVAN ST, NP	77
SWIFT ST, PR	809
TABER AV, PR	3,833
TAFT AV, PR	625
TAFT ST, CR	513
TALBOT MN, CR	758
TOP HILL RD, NP	1,206
TOURO ST, PR	1,271
UPTON AV, PR	1,304
URBAN AV, NP	1,862
VALE AV, CR	327
VASSAR AV, PR	936

Water Main Rehabilitation**Projected 5-Year Plan Streets (2016-2020)**

<u>Street</u>	<u>FT</u>
VAUGHN ST, PR	201
VERMONT AV, PR	1,813
VILLA AV, CR	798
VINCENT AV, NP	1,919
VIVIAN AV, NP	614
VOLTURNO ST, NP	1,769
WAITE AV, CR	1,268
WANDA CT, NP	225
WARD AV, NP	1,344
WARWICK AV, CR	488
WASHINGTON AV, PR	1,918
WESTERN PROMENADE ST, CR	1,136
WESTFORD RD, PR	852
WESTWOOD AV, CR	1,041
WEYMOUTH ST, PR	1,033
WHEELER AV, CR	2,337
WHITING ST, PR	345
WINDMILL ST, PR	184
WINGATE RD, PR	926
WOODBINE ST, CR	3,610
WOODBURY ST, PR	1,840
TOTAL	372,999 ft
	(70.64 mi)